POLYCHLORINATED DIOXIN AND FURAN LEVELS IN SAWMILL SOILS

Sandell, E.[A], Tuominen, J.[A]
[A] Technical Research Centre of Finland, P. O. BOX 204, SF-02151 Espoo, Finland

INTRODUCTION

Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) have been found in technical pesticides, in chlorophenolic wood preservatives (for example KY-5), in PCBs, in industrial waste waters and from car exhausts using leaded fuel. In Finland there are over 300 sawmills and factories producing timber, lumber, plywood and fiberboard. Their total production was 9.3 million m^3 in 1983. In order to protect the wood products against blue staining fungi and soft rot during storage and shipping, KY-5 was used[1]. Its usage stopped in 1985 but as late as 1983, 2.7 million cubicmeter wood had been treated with KY-5 in Finland. Therefor soils of sites where wood preservatives had been used, could be contaminated.

EXTRACTION AND CLEANUP

The soil samples (20 g) are soxhlet extracted with acetone:dichloromethane (1:1) for 12 h [2] . The extract is dried with Na_2SO_4 and then the sample extract is diluted and 1 ml is taken (internal standards are added) for the cleanup and 50 µl tetradecane is added and dried in an evaporator. The sample is redissolved in a small amount of dichloromethane and then transferred to the top of the precolumn with a small amount of hexane. The cleanup consists of four columns; a silica/KOH-silica precolumn, an acidic silica column containing copper chips for removal of sulphur, a basic alumina column and an active carbon column [3].

INSTRUMENTATION

MASS SPECTROMETER JEOL SX-102

- EI-ion source
- inlet temperature 250 °C
- source temperature 250 °C
- filament current 600 µA
- ionization voltage 50 V
- filter 3000 kHz
- ion multiplier 3.0 kV
- electrofield jumping 60 ms
- resolution 10000

HP 5890 GC-CONDITIONS

- DB-DIOXIN capillary column
- column length 60 m
- internal diameter 0.32 mm
- phase thickness 0.20 µm
- column pressure 15 Psi
- splitless injection 60 s
- injection temperature 280 °C
- oven program: 200°C, 1 min, 15°C/min, 220°C, 36.77min, 15°C/min, 270°C, 40 min.

RESULTS AND DISCUSSIONS

In our research we found high amounts of TCDD-equivalents (NORDIC) in soils from an old sawsite. The dominant congeners were 1,2,3,6,7,8-hexa-CDD, 1,2,3,4,6,7,8-hepta-CDD, OCDD, 1,2,3,4,7,8-hexa-CDF, 1,2,3,6,7,8-hexa-CDF, 2,3,4,6,7,8-hexa-CDF, 1,2,3,4,6,7,8-hepta-CDF and OCDF. In the surface layers (0-0.2 m) the amounts of Nordic toxic equivalents ranging from 1.7 µg/kg dry soil to 85.0 µg/kg dry soil in the area were the wood piles were stored. This was caused by the fact that the wood normally was transported to the storing area while still wet and dripping. The amounts of the Nordic equivalents in the deeper layer (0.2 to 0.5 m) had decreased by about a factor of 10 (Figure 1). The concentrations of dioxins and furans at the points 6 and 7 are extremely high because heavily contaminated soil and used preservatives (KY-5) were dumped there.

CONCLUSIONS

In this study it was found that the dioxins and furans present were congeners of higher chlorinated range (hexa-, hepta- and octachlorinated). These have been impurities in the chlorophenol based KY-5 woodpreservative used at the site. The research also shows that when replanning old saw areas where KY-5 or otherchlorophenol based preservatives had been used it is only necessary to remove the surface layer to allow reusing.

LITERATURE:

1. Gunilla Lindström, Polychlorinated dibenzo-p-dioxins and dibenzofurans: Analysis of and Occurence in milk, Department of Organic Chemistry, Environmental Research Group, University of Umeå, Sweden.

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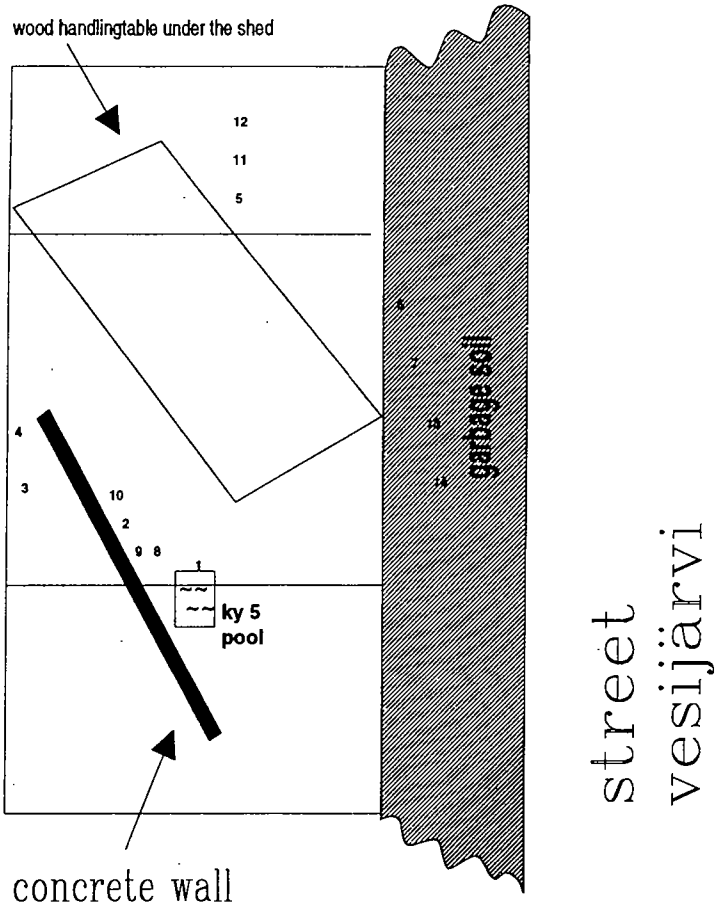
3. Lars-Owe Kjeller, Upparbetning och analys av polyklorerade dibenso-p-dioxiner (PCDD) och polyklorerade dibensofuraner (PCDF) i sediment och jordprover, Enheten för Miljökemi, Umeå 89-01-23



concentration of PCDD/PCDF in toxic equivalents (Nordic model) in µg/kg dry soil

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
0 – 0.2 m	3.5	16.1	8.5	4.1	32.8	71.4	50.4	3.5	1.7	8.4	2.5	6.8	30.0	85.0
0.2 – 0.5 m	0.9	0.2	1.8	1.7	5.3	582	994	0.2	0.1	0.1	0.8	1.3	6.7	9.8

Figure 1. The handling section of timber and lumber products.